

US5446659:Traffic accident data recorder and traffic accident reproduction system

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Abstract:

A traffic accident data recorder comprising an acceleration sensor 3, an angular velocity sensor 4 if necessary, a memory 8, and a control section 7 for controlling the recording in the memory 8. When the output datum from the acceleration sensor 3 or the angular velocity sensor exceeds a predetermined value, the control section 7 recognizes that time as a traffic accident occurrence time, and stores the acceleration data and angular velocity data before and after then or after then in the memory 8. By analyzing the data with a traffic accident data reproduction system, it is possible to reproduce the state at the traffic accident occurrence time.

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What is claimed is:

1. A traffic accident reproduction system for reproducing a traffic accident of a vehicle during a predetermined time period after a traffic accident occurrence time,

the traffic accident reproduction system comprising:

- acceleration measurement means for measuring acceleration of the vehicle in three axial directions in a three-dimensional space to output acceleration data,
- angular velocity measurement means for measuring angular velocity of the vehicle about three directional axes in a three-dimensional space, to output angular velocity data,
- storage means for storing the acceleration data and the angular velocity data,
- control means for determining the traffic accident occurrence time by recognizing a time when a predetermined acceleration value has been exceeded by a respective acceleration datum obtained by the acceleration measurement means or a predetermined angular velocity value has been exceeded by a respective angular velocity datum obtained by the angular velocity measurement means, to start the acceleration data and the angular velocity data being stored in the storage means, and for stopping the acceleration data and the angular velocity data from being stored in the storage means when the predetermined time has passed after the traffic accident occurrence time,
- analyzing means for analyzing the acceleration data and the angular velocity data from said storage means to obtain traffic accident data indicating the speed, posture and position of the vehicle during said predetermined time period, and
- visualizing means for visualizing the speed, posture and position of the vehicle based on said traffic accident data during said predetermined time period.

Background/Summary:

FIELD OF THE INVENTION

The present invention relates to a traffic accident data recorder mounted on a vehicle for land transportation such as a car, a vehicle for marine transportation such as a ship, or other vehicles such as an aircraft, or the like. The recorder stores acceleration and angular velocity data of the vehicle prior to and at a traffic accident (which is defined as a general term for vehicle accidents which occur on the earth, on the sea and in the air), and the occurrence time. The invention further relates to a traffic accident reproduction system for reproducing the traffic accident by using the traffic accident data stored in the traffic accident data recorder.

BACKGROUND OF THE INVENTION

Generally, it is very advantageous to know the condition or state of a vehicle

when a traffic accident has occurred involving the vehicle, in order to look into the cause of the accident. As an example of apparatus representative for storing data at a traffic accident occurrence time, a flight recorder mounted on an aircraft is well known. The flight recorder for an aircraft receives and records data such as the speed, acceleration, etc. of the aircraft body through wires from hydraulic cylinders, the speed indicator, sensors, etc. in the aircraft continuously while the aircraft is flying. The recording operates at least for the time from when the airplane has once taken off until it has landed.

Such a flight recorder is a very large scale and complex apparatus which, as stated above, needs data supplied from the hydraulic cylinders, speed indicator, sensors, etc. in the aircraft; there are no known examples where such a system is mounted on vehicles other than large aircraft.

On the other hand, in a traffic accident involving a vehicle such as a ship and a car, other than an aircraft, it is also very advantageous to analyze data of, for example, acceleration, angular velocity, etc. of the vehicle at the accident occurrence time, in order to look into the cause of the accident. However, because an aircraft flight recorder is a very large scale apparatus, it is not practical to apply such a system to other vehicles because of the complex mounting requirements, costs, etc., although it is theoretically possible.

The British patent publication GB 2,020,127 A discloses an accident recording system including an accelerometer. This system merely stores acceleration data during a certain time period until the vehicle speed and acceleration become zero. Therefore, this time period may not contain a traffic accident occurrence time. Also, because the above system measures only the speed and acceleration, it is not possible to know what the orientation of the vehicle has been, i.e., whether the vehicle has turned sideways or slipped sideways in an accident.

The present invention has been made in view of the foregoing situation; it is an object of this invention to provide a traffic accident data recorder, with which it is possible to determine a traffic accident occurrence time, and obtain acceleration and/or angular velocity data during a predetermined time period after or before and after the recognized time. By obtaining the angular velocity data, it is possible to know what the orientation of the vehicle has been. It is another object of the invention to provide a traffic accident reproduction system, which can reproduce the traffic accident from the acceleration and/or angular velocity data stored in the traffic accident data recorder.

SUMMARY OF THE INVENTION

A traffic accident data recorder according to the present invention is operable on a vehicle to store acceleration data of the vehicle during a predetermined time period after the time of a traffic accident. The recorder comprises acceleration measurement means for measuring acceleration at least in the traveling direction of the vehicle in a three-dimensional space to output acceleration data, storage means for storing the acceleration data, and control means for determining the traffic accident occurrence time by recognizing a time when a predetermined value has been exceeded by an acceleration datum obtained at the acceleration

measurement means, for starting the storage of the acceleration data in the storage means, and for terminating the storage of the acceleration data when the predetermined time has passed after the traffic accident occurrence time.

Another traffic accident data recorder according to the invention is operable in a vehicle to store acceleration data of the vehicle during a predetermined time period before and after a traffic accident occurrence time, and it comprises acceleration measurement means for measuring acceleration at least in the traveling direction of the vehicle in a three-dimensional space to output acceleration data, storage means for storing constantly and endlessly the acceleration data during the predetermined time period up to the time of inspection, and control means for determining the traffic accident occurrence time by recognizing a time when a predetermined value has been exceeded by an acceleration datum obtained at the acceleration measurement means, and for terminating the storage of the acceleration data when the predetermined time has passed before and after the traffic accident occurrence time.

Another traffic accident data recorder according to the invention is operable on a vehicle to store acceleration data and angular velocity data of the vehicle during a predetermined time period after a traffic accident occurrence time, and it comprises acceleration measurement means for measuring acceleration at least in the traveling direction of the vehicle in a three-dimensional space to output acceleration data, angular velocity measurement means for measuring angular velocity about at least one directional axis in the three-dimensional space, to output angular velocity data, storage means for storing the acceleration data and the angular velocity data, and control means for determining the traffic accident occurrence time by recognizing a time when a predetermined value has been exceeded by an acceleration datum obtained at the acceleration measurement means or an angular velocity datum obtained at the angular velocity measurement means, to start the acceleration data and the angular velocity data being stored in the storage means, and for stopping the acceleration data and the angular velocity data from being stored in the storage means when the predetermined time has passed after the traffic accident occurrence time.

Another traffic accident data recorder according to the invention is operable on a vehicle to store acceleration data and angular velocity data of the vehicle during a predetermined time period before and after a traffic accident occurrence time, and it comprises acceleration measurement means for measuring acceleration at least in the traveling direction of the vehicle in a three-dimensional space to output acceleration data, angular velocity measurement means for measuring angular velocity about at least one direction in a three-dimensional space, to output angular velocity data, storage means for storing constantly and endlessly at certain periods the acceleration data and the angular velocity data during the predetermined time up to the present time, and control means for determining as the traffic accident occurrence time by recognizing a time when a predetermined value has been exceeded by an acceleration datum obtained at the acceleration measurement means or an angular velocity datum obtained at the angular velocity measurement means, and for terminating the storage of the acceleration data and the angular velocity data when a predetermined time has passed before and after

the traffic accident occurrence time.

A traffic accident reproduction system according to the invention analyzes the acceleration of the vehicle, according to the acceleration data taken out of the traffic accident data recorder/s described above.

Another traffic accident reproduction system according to the invention analyzes the acceleration and angular velocity of the vehicle, according to the acceleration data and angular velocity data taken out of the traffic accident data recorder/s described above.

Constitution may be added which visually reproduces the speed of the vehicle according to the acceleration obtained by analyzing the acceleration data.

Further, constitution may be added which visually reproduces the speed and position of the vehicle according to the acceleration and angular velocity obtained by analyzing the acceleration data and angular velocity data.

The traffic accident data recorders of the above construction are used as mounted on vehicle such as cars, ships and aircrafts. Generally, when a vehicle encounters a traffic accident, it is quickly braked or, without quick braking, it crashes against or collides with something, or something collides with it from behind. Therefore, if the acceleration and angular velocity of the vehicle have been recorded, it is possible to know with their rapid changes when the traffic accident occurred. The traffic accident data recorders of the present invention record acceleration data and, if necessary, angular velocity data of a vehicle during a predetermined time period after a traffic accident occurrence time or a predetermined time period before and after the accident occurrence time.

The acceleration data show the speed changes of the vehicle at the accident occurrence time, and one can know from the data the shock of collision or crash, for example. The acceleration data are measured by the acceleration measurement means, for at least the traveling direction of the vehicle and, if necessary, the other directions than the traveling direction in the three-dimensional space. The measurement is carried out constantly while the vehicle is running. As the acceleration measurement means, acceleration sensors of various types may be used, such as the strain gage type, capacitance type, piezoelectric type and differential transformer type. The acceleration measured by the acceleration measurement means is outputted as acceleration data.

The angular velocity data show the changes in direction or position of the vehicle at the accident occurrence time, and one can know from the data how the direction of the vehicle has changed at the accident occurrence time. The angular velocity data are measured by the angular velocity measurement means, on the angular velocity about at least one direction in the three-dimensional space and, if necessary, on the angular velocity about the other directions. This measurement is also carried out constantly while the vehicle is running. As the angular velocity measurement means, various commercial angular velocity sensors may be used. The angular velocity measured by the angular velocity measurement means are output as angular velocity data.

The acceleration data output from the acceleration measurement means and the angular velocity data output from the angular velocity measurement means are stored by the storage means. The storage means may be a semiconductor

memory or a magnetic recorder using a magnetic medium or the like. In the present invention, the control means controls the storage of the data in the storage means.

Specifically, the control means recognize the traffic accident occurrence time. The traffic accident occurrence time is defined as the time when the predetermined value has been exceeded by the acceleration data obtained at the acceleration measurement means or the angular velocity data obtained at the angular velocity measurement means. If the traffic accident occurrence time is recognized, the acceleration data and, if necessary, the angular velocity data are started being stored in the storage means. When the predetermined time has passed after the traffic accident occurrence time, the acceleration data and angular velocity data are stopped from being stored in the storage means. This construction makes the storage means store the acceleration data and, if necessary, the angular velocity data for the period after the vehicle encounters the traffic accident until the vehicle stops completely.

In the traffic accident data recorders storing the acceleration data and, if necessary, the angular velocity data before and after the traffic accident occurrence time, the storage means constantly stores the acceleration data and angular velocity data. This recording is carried out endlessly; accordingly, new data replace old data in order at regular intervals. The control means recognizes the traffic accident occurrence time which is defined as the time when the predetermined value has been exceeded by the acceleration data obtained at the acceleration measurement means or the angular velocity data obtained at the angular velocity measurement means. When the predetermined time has passed before and after the traffic accident occurrence time, the acceleration data and angular velocity data are stopped from being stored in the storage means. This construction makes the storage means store the data for the period from the predetermined time before the vehicle encounters the traffic accident until the vehicle stops completely.

The traffic accident reproduction systems of the present invention analyze the acceleration and angular velocity of the vehicle, according to the acceleration data and, if necessary, the angular velocity data taken out of the traffic accident data recorders. If it is possible to know the acceleration and angular velocity of the vehicle at the traffic accident occurrence time, it is very easy to analyze the cause of the traffic accident.

The traffic accident reproduction systems of the invention may be constructed to visually reproduce on, for example, a display screen the speed and direction of the transportation means, which has encountered the accident, according to the acceleration and, if necessary, the angular velocity of the transportation means. This easily allows the cause to be analyzed further.

Because the traffic accident data recorders of the present invention do not need signals, as the conventional flight recorders do, from parts of vehicle on which they are mounted, no wiring is needed to supply the signals. Therefore, it is possible to easily analyze a traffic accident by a simple operation of merely mounting on a vehicle a traffic accident data recorder according to the present invention. Also, because it is possible to use acceleration sensors and angular velocity sensors

which are supplied as highly general, independent units, it is possible to produce a traffic accident data recorder at a remarkably low cost in comparison with flight recorders.

Also, the traffic accident reproduction system can easily analyze the speed, position, direction, etc. of a vehicle at a traffic accident occurrence time, according to the data recorded in the traffic accident data recorder mentioned above. Therefore, it is possible to look into the cause of a traffic accident in a very short time and accurately. Also, because a traffic accident can be reproduced visually, it is possible to easily look into the cause of the accident.

Further, according to the present invention, because the data to be recorded are only the data during a predetermined time period when a traffic accident occurs, a small memory capacity suffices. Also, because the traffic accident data recorder has only an acceleration sensor, an angular velocity sensor if necessary, a semiconductor memory, a very small control means such as a microcomputer, etc., it has the advantage of being able to make the whole recorder small in size.